VETERINARY PARASITOLOGY IN PARAGUAY

1971-72

NMSU-AID

REPORT ON A THREE-MONTH DETAIL IN PARAGUAY

Rex W. Allen
Research Zoologist
Veterinary Sciences Research Division
Agricultural Research Service
U. S. Department of Agriculture
Las Cruces, New Mexico

TABLE OF CONTENTS

TABLE OF CONTENTS

INTRODUCTION

This is a description of a detail as consultant in veterinary parasitology for the New Mexico State University (NMSU)-AID program of assistance to the Facultad de Agronomia y Veterinaria (FAV) and the Ministerio de Agricultura y Ganaderia. My assignment was arranged by the Foreign Economic Development Service, USDA (Mr. James Gehr, Washington), through a Participating Agency Service Agreement, USDA (Dr. V. I. Plath, Asuncion). Chief of Party for the NMSU contract was Professor Charles M. Gay. My counterparts in FAV were Raphael Masi Pallares, M.D., and Carlos Benitez Usher, D.V.M., M.S.

My stay in Paraguay lasted from October 14, 1971 to January 13, 1972. I had previously served a similar detail from September 28 to December 30, 1965. The 1965 assignment was concerned chiefly with the setting up of a laboratory for diagnostic and research purposes and with a preliminary appraisal of the importance of parasitism in cattle production. During the interval between my two visits, many improvements had been made in the teaching and research programs in veterinary parasitology. The program is still headed by Dr. Masi, but the staff now also consists of two veterinarians and one technician. One of the veterinarians, Dr. Benitez, spent two years at Auburn University, Alabama, completing work for a Master's degree. Dr. Benitez hopes to pursue studies leading to a Ph.D. degree.

Drs. Masi and Benitez are dedicated teachers and research workers; they have published several important papers in recent years. One of their publications is a checklist of parasites found thus far in Paraguay. In this important work they have listed 152 species of parasites from more than 15 different host animals. For cattle they have recorded about 34 species; for sheep, 16 species; and for swine, 15 species. Records of this type are basic to almost any type of research program for the country. The collection and identification of the parasites involved represents an enormous amount of work, and Drs. Masi and Benitez are well on their way in completing a comprehensive catalog and collection of the parasites of the country.

My arrival in Paraguay was timed so that I could participate in the Primeras Jornadas de Ciencias Veterinarias del Paraguay, a three-day program designed for the veterinarians of the country. Participating were various specialists in the veterinary sciences and animal production from Paraguay, Uruguay, Argentina, and NMSU-AID. My contribution to the program was a paper entitled "Newer Knowledge about Control and Treatment of Some Parasitic Diseases."

The objectives of my assignment, as outlined by NMSU-AID, were to (1) work with Drs. Masi and Benitez developing laboratory diagnostic-teaching programs, (2) establish a program of priority research in beef-dairy cattle parasites, and (3) organize a short course in animal sanitation.

OBJECTIVE 1

Appraisal of FAV Services in Veterinary Parasitology

The teaching is handled by a very competent staff of one medical doctor and two veterinarians, one of whom has had graduate training in the United States. Teaching load does not appear to be excessive. Two courses are taught for the veterinary students. The first, a general course in parasitology, is taught in the second year of the veterinary curriculum. About 40 students, in four sections of 10 each, take this course. In the third year, a course is taught in parasitic diseases; about 10 students take this course. Both courses entail about three to four hours of lecture and laboratory instruction per week. At the end of the period of formal classes, there is an examination period lasting from one to two months.

The staff has at its disposal a very adequate library for teaching purposes. The latest textbooks are available; some of these are in English (two of the staff members read English and one is fluent in the language), some in Portuguese, but most are in Spanish. There is an abundance of illustrative material on view in the teaching laboratory, and there are several collections of slides for projection. Some of the slides were furnished by commercial firms, some were purchased, and some are the personal property of the teaching staff. There is a collection of specimens mounted on microscope slides, but the microscopes available for their study are inadequate in number and quality. There is a need for teaching films; these might be made available through the AID Film Service from the U.S. Department of Agriculture, Washington, the Communicable Disease Center, Atlanta, and other sources.

For research and diagnostic purposes, the library is inadequate in some respects, particularly in journals of the abstract variety. No journals of this type are now subscribed to, and there are no back issues on hand. To keep abreast of the voluminous literature in the field, abstract journals are considered absolutely essential. There are several of these which cover the field of veterinary parasitology, and one of them - The Veterinary Bulletin, yearly subscription rate $91.00 - covers all fields of veterinary medicine and thus would be beneficial to the entire veterinary staff of FAV. Also needed is a complete set of the Index Catalogue of Medical and Veterinary Zoology (USDA). FAV is now on the mailing list for this publication, and most of the back issues have been received.

It is regrettable but there appears to be no source of public funds for journal subscriptions. Fortunately, Drs. Masi and Benitez subscribe on a personal basis to a few journals in the field. To fill the hiatus, it is suggested that some means be found to subscribe to The Veterinary Bulletin, thus providing at least one abstract journal for the whole veterinary school. Arrangements will be made to forward more or less regularly from the USDA Parasite Research Laboratory, Las Cruces, copies of Current Contents, which give titles in veterinary science, including parasitology. Selection of important titles can be made from this source and requests for abstracts or reprints of articles desired forwarded to the Center for International Programs, NMSU,

Appraisal of FAV Services in Veterinary Parasitology

[illegible] teaching is handled by a very competent staff of [illegible] two veterinarians, one of whom has had graduate training in [illegible]. Teaching load does not appear to be excessive. Two courses [illegible] the veterinary students. The first, a general course in parasitology, [illegible] in the second year of the veterinary curriculum. [illegible] sections of 10 each, [illegible] this course. [illegible] taught in parasitic diseases; about [illegible] students take this course. [illegible] about three to four hours of lecture and laboratory instruction [illegible]. At the end of the period of formal classes, there is an [illegible] of lasting [illegible] to the month.

The staff has at its disposal a more adequate library for teaching [illegible] poses. The latest textbooks are available; several of them are in English. [illegible] of the staff members read English [illegible] other languages, [illegible] ocuments, but most are in Spanish. There is an abundance of illustrative material on view in the teaching laboratory, and there are several [illegible] of slides for projection. Some of the slides were furnished by [illegible] some were purchased, and some are the personal property of the [illegible]. There is a collection of specimens mounted on microscope slides, but [illegible] the microscopes available for their study are inadequate in number [illegible] is a need for teaching films; these might be made available through the [illegible] Service from the U.S. Department of Agriculture, Washington, [illegible] Disease Center, Atlanta, and other sources.

For research and diagnostic purposes, the library is inadequate in [illegible] respects, particularly in journals of the abstract variety. No journals of this type are now subscribed to, and there are no back issues on hand. [illegible] abreast of the voluminous literature in the field, abstract journals are considered absolutely essential. There are several of these which cover the field of veterinary parasitology, and one of them - The Veterinary Bulletin, [illegible] subscription rate \$14.00 - covers all fields of veterinary medicine and [illegible] would be beneficial to the entire veterinary staff of [illegible]. [illegible] a complete set of the Index Catalogue of Medical and Veterinary Zoology [illegible]. FAV is not on the mailing list for this publication, and most of the back issues have been received.

It is regrettable but there appears to be no source of public funds for journal subscriptions. Fortunately, Drs. [illegible] and [illegible] subscribe on a personal basis to a few journals in the field. To fill the hiatus, it is suggested that some means be found to subscribe to The Veterinary Bulletin, thus providing at least one abstract journal for the whole veterinary school. [illegible] arrangements will be made to forward more or less regularly from the [illegible] Research Laboratory, Les Cruces, copies of Current Contents, which [illegible] titles in veterinary science, including parasitology. Selection of [illegible] articles can be made from this source and requests for abstracts or reprints of articles desired forwarded to the Center for International [illegible], [illegible]

through NMSU-AID. FAV (veterinary parasitology) is in need of a style manual of the American Institute of Biological Sciences. This manual would enable the staff to prepare manuscripts in a style suitable for most biological journals. The manual has been ordered.

The laboratory is urgently in need of some improvements and equipment. The following are suggested:

1. The water supply is inadequate and should be improved.

2. A kitchen type refrigerator should be made available for perishables. Nearest refrigeration now is 60 meters away.

3. The need for a good microscope equipped with camera for photomicrographs will be satisfied when equipment now on order arrives.

4. The laboratory is in need of air conditioning. I understand a unit is now on order.

5. A Bunsen burner is badly needed as a source of heat in making solutions, heating slides, sterilizing instruments, and working glass. This could be fueled from tanks of gas, available in the area.

6. A small electric shaker and a simple electric stirrer would expedite the handling of fecal samples for diagnosis.

7. For the same purpose, some additional Mcmaster slides of both sheep and cattle varieties are needed for counting worm eggs.

8. Additional mechanical counters are needed for worm eggs, worms, and other objects. At least one of these should be a six bank counter.

9. A few four liter, wide-mouth glass jars are needed for culturing feces for demonstration, teaching, and diagnostic purposes. A supply of granular bone charcoal, sterile sand, and/or sphagnum moss are needed for this procedure, as is a weak solution of HCL. The HCL is used as an additive for material extracted from fecal cultures or from Baermann funnels; it kills the larva and adult free-living nematodes which often contaminate such material and make identifications difficult.

10. An assortment of common laboratory stains is needed.

OBJECTIVE 2

Priority Research Projects

Based on the knowledge at hand concerning parasitism in Paraguay, lists of suggested research topics were drawn up and grouped into those that might be handled in a comparatively short time and those that might be considered long term types of projects. These lists are attached. They served as a guide in setting priorities.

As a further help in selecting priority research, a series of field trips was undertaken in order to make first-hand observations on occurrence of parasitism, on ranching procedures, and on parasite control methods now in use. A total of eight ranches in various parts of the southern, more populous, part of the country were visited. On six of these ranches, a total of 41 fecal samples were taken from cattle to aid in determining parasite loads. The fact that the average age of the cattle sampled was several years, and the fact that anthelmintics were in use at all of the places visited indicated that only very low egg counts could be expected. This was the case. Only nine of the samples showed any worm eggs at all; the maximum number in any one sample was 100 per gram of feces. These results are indicative of very low parasite loads. Although few observations of a quantitative nature are on record, it is the consensus among veterinarians and ranchers in Paraguay that worm parasitism is a problem of great importance.

Cattle in many areas of Paraguay are infested with large numbers of external parasites, one of the most prevalent being a grub which occurs in and beneath the skin. This grub is the larval stage of a fly called Dermatobia hominis. A common name for the condition is "Ura." This parasite is one of the most destructive in existence. The lesions it causes usually reach a diameter of three to five centimeters, and the attendant swellings stand out markedly on the skin surface. The lesions often exude pus, attract flies and probably other secondary invaders, and are extremely unsightly. Large areas of subcutaneous tissues are affected.

Dermatobiasis is generally distributed over the country. In some localities and on some ranches, the incidence is 100%. In heavily infested animals, there may be hundreds of lesions involving most of the skin area. A fair estimate is that 25 to 50% of the cattle in the southern half of the country are infested; in the Chaco, the parasite appears to be less a problem, but precise data on this subject is lacking. Many animals other than cattle, including man, are affected by the parasite, thus complicating the problem of control in cattle.

With the above information in mind, my two FAV counterparts and I prepared outlines of three research proposals ranked in order of priority. The Ura problem seems to rank first in importance. Next is the problem of gastrointestinal and lung nematodes (roundworms). The research proposals dealing with these problems include one on Ura and two on nematodes. The titles are as follows:

A. The Biology and Control of Dermatobiasis

B. Survival of the Larvae of Parasitic Nematodes on Various Types of Pasture

C. Worm Parasitism in Dairy Calves in the Asuncion Area

Copies of these proposals follow.

Suggested Research Topics in Veterinary Parasitology*

Short term:

1. Determine which oribatid mites transmit tapeworms of sheep, cattle, and horses.
2. Incidence of trichinosis in pigs, dogs, cats, and rodents.
3. Incidence of cysticercosis in pigs and cattle.
4. Determine the principal parasites involved in clinical cases of parasitism.
5. Incidence of trematodes in ruminants.
6. Incidence of Ura in various breeds of cattle.
7. Morphology of Haemonchus placei and contortus complex in cattle and sheep.
8. Incidence of Physacephalus sexalatus in pigs, chickens, and other birds.
9. Incidence of Agriostomum in cattle.
10. Occurrence of horn flies and stephanofilariasis in cattle.
11. Occurrence of Thysanosoma and Thysaniezia in ruminants.
12. Susceptibility of various stages of Ura to Neguvon injections.
13. Duration of protection afforded to cattle by Neguvon injections.
14. Effect of Neguvon injections on egg production of gastrointestinal worms.

*Some of the research which would be involved in these suggested topics are covered in the attached Research Proposals.

Suggested Research Topics in Veterinary Parasitology*

Long term:

1. Pathogenicity of *Haemonchus similis* to calves and lambs.

2. Efficacy of anthelmintics against *H. similis* of cattle.

3. Evaluate importance of swine lungworms, and determine species and vectors.

4. Life history of *Tridontophorus* of the horse.

5. Efficacy of low level administration of drugs in reducing worm egg counts and incidence of Ura.

6. Effect of burning and/or clipping on the survival of worm larvae on pasture.

7. Cross immunity between *H. contortus* and *H. similis* of cattle.

8. Seasonal survival of nematode larvae on forages of various types.

9. Most efficient ways of administering drugs for the control of endo- and ectoparasites. Test backrubbers, pour-on, salt blocks, loose salt, feed concentrates such as ground sugar cane, and injections.

10. Geographical distribution of Ura in Paraguay.

11. Efficacy of tetramisole (levo) (injectable and oral) in controlling gastrointestinal worm parasites and lungworms.

12. Occurrence of *Linguatula* larvae in the lymph nodes of cattle.

13. Incidence of sarcosporidiosis in cattle, sheep, and swing.

*Some of the research which would be involved in these suggested topics are covered in the attached Research Proposals.

RESEARCH PROPOSAL

Parasites and Parasitic Diseases of Cattle in Paraguay

1. Title: The Biology and Control of Dermatobiasis (Ura)

2. Objectives: (a) To accumulate knowledge concerning the life history and mode of transmission of Dermatobia under Paraguayan conditions in order to formulate methods of control, and (b) to conduct controlled experiments designed to evaluate chemical treatment of infected cattle.

3. Background: This parasite affects many different species of animals. Its distribution is Central Mexico southward. No other parasite causes such unsightly lesions and such extensive damage to host tissues as Dermatobia. Not only are vast numbers of cattle hides ruined but large areas of subcutaneous tissues are affected by the inflammatory reactions of the host to the parasite. The stage which causes the damage is a larva of a fly (Diptera). The life history involved is unique. The adult stage is not parasitic and does not come in contact with the host animal. Instead the fly captures mosquitoes and other flying insects which frequent warm-blooded animals and deposits on these insects batches of eggs. The eggs are stimulated to hatch as the carrier comes in contact with the hosts, and the resulting larvae penetrate the skin and proceed to grow and develop in the subcutaneous tissues. When development is complete the larvae emerge through the holes they have made in the skin and drop to the ground, burrowing in to some depth. Development continues and finally results in the emergence of the adult stage of the fly. The larval stages in the skin are susceptible to chemicals, and control measures directed at the fly and at the carriers might be fruitful.

   A great deal of research has been done on Dermatobia in Central America and in some countries in South America, but none has been done in Paraguay. Although the parasite is widespread in this country, precise information as to its geographical distribution, incidence, intensity of infestation, seasonal occurrence, cattle breed susceptibility, and age susceptibility is lacking. The carrier insects in Paraguay have not been identified, and other aspects of the life cycle in this country are still unknown. Information of this kind might provide valuable clues upon which to base a control program. Chemical control of Ura by treating cattle likely would provide additional benefits through the control of other ectoparasites and possibly some endoparasites as well. No controlled evaluations of chemical treatments have been made in this country.

4. Methods: Biology of Ura - Select a number of ranches (say 4 to 6) located in such a way as to give information about widely separated areas in the country. Visit the ranches semimonthly or at least monthly and observe a significant number of animals to determine incidence (percentage of infested animals), intensity of infestation (number of lesions per infested animal). Observations made periodically will give data on

seasonal occurrence. Record data in such a way as to show importance of breed, color, and age differences in susceptibility. Learn about transmission of the parasite under Paraguayan conditions by identifying the carriers and relating this information to geographical and climatic conditions. Attempt to ascertain why Ura is present in some areas but not in others. Undertake laboratory studies with larvae removed from lesions in cattle, place them in soil in closed containers and attempt to recover the adult flies developing from the larvae. To the adult flies expose various candidate carriers to obtain attachment of eggs. Let infested carriers feed on susceptible hosts thus completing the life cycle under laboratory conditions. This research would provide information about the time required for development, the evolution of the lesions and about soil, moisture, and temperature conditions conducive to development.

Control of Ura - Results of research on the biology may provide clues as to ways of preventing infestation through sanitation. For example, if only certain types of soil are suitable for the development of Ura, such types might be avoided during periods of heavy infestation or they might be rendered unsuitable for Ura development by chemical treatment or by plowing. Chemical control might be used on foliage and/or water frequented by the Ura fly or the carriers. Chemical treatment may be applied to the cattle for purposes of treatment or prevention. Applications may be made externally by means of dipping, spraying, and pour-on, and internally by dosing or injection. Such chemical as BHC or DDT can be used only externally while some organophosphates (Neguvon and Asuntol) can be given internally as well as externally, and these have the added advantage of affecting worm parasites. Orally, one may dose periodically or use a low level, continuous feeding plan involving medicated salt (loose or blocks), mineral mixes, or feed concentrates. Drug resistance may develop so that the use of alternate drugs should be considered. The organophosphates have the widest spectrum of effect but they must be used strictly in accordance with instructions to avoid potentially dangerous residue problems. For Ura, louse, tick, and fly control, evaluate BHC in oil on backrubbers. For control of these parasitic conditions as well as internal worm parasites, evaluate BHC externally at the same time that the cattle are receiving an organophosphate in mineral-salt mix. Evaluate simultaneously the use of organophosphate on backrubbers and in mineral-salt mix. Measure efficacy of control measures in a statistically valid manner, keeping in mind that there may be benefits as regards worm parasites, ticks, lice, and mites. It should be emphasized that treatments administered on a herd basis in the pasture are highly desirable in order that costly rounding up and handling of animals individually may be avoided.

5. Duration: Three years

6. Cost in guaranies (126 Gs = $1.00):

	Year			
	1	2	3	Total
Cages for flies - 6	3,000			3,000
Plastic bags	1,000	1,000		2,000
Clipboards - 4	1,200			1,200
Carbon dioxide - 3	2,000	2,000	2,000	6,000
Backrubbers	8,000	8,000	8,000	24,000
Chemicals				No charge
Mineral-salt mixes				No charge
Calves free of Ura	4,000	4,000	4,000	12,000
Feed	1,000	11,000	11,000	33,000
Personnel:				
Professional				No charge
Student	24,000	24,000	24,000	72,000
Animal Caretaker	12,000	12,000	12,000	36,000
Travel:				
Actual expenses	26,000	26,000	26,000	78,000
Car	84,000	84,000	84,000	252,000
	176,200	172,000	171,000	519,200

RESEARCH PROPOSAL

Parasites and Parasitic Diseases of Cattle in Paraguay

1. Title: Survival of Larvae of Parasitic Nematodes on Various Types of Pasture

2. Objective: To determine the effect of various animal husbandry practices in preventing the survival of nematode larvae on pastures

3. Background: The severity of nematodosis in food animals is determined largely by the ability of the free-living stages (larvae) to survive on pastures. This survival may be influenced markedly by types of forage and climatic conditions. The larvae hatch from eggs passed in the manure of the host animal. Normally, they become motile on forage, moving up and down on the plants in adhering drops of moisture. They tend to move upward on the plant where they are more readily available to grazing animals. Their activity is influenced by temperature, and extremes of temperature are detrimental to their development and survival.

   Some species are more resistant to adverse climatic conditions than others. Sunshine and drying are harmful to most species, and their survival time usually is only a few days. Thus, it may be possible to manipulate conditions in such a way as to make survival of the larvae hazardous. These manipulations may take the form of burning of pastures and utilizing types of grasses that afford a minimum of protection to the larvae.

   There are different ways of measuring populations of larvae on forage. One may attempt to recover larvae directly from grasses and soil from contaminated pastures. Also, one may set up small areas (for example, bottomless metal cans surrounding a plant) and seed them with feces from infected animals. Periodically small plant and soil samples may be taken from such experimental areas for the extraction of the larvae. Extraction methods involve washing and sedimenting the material. Due to the microscopic size of the larvae and to other complicating factors, these procedures are time-consuming and costly in man hours and equipment. Another method is to graze suitable experimental animals on contaminated pastures, following the course of infections acquired from the pastures by means of periodic quantative analyses of manure samples. Postmortem examination of representative animals at the termination of exposures will enhance the accuracy of the tests.

4. Methods: (1) In suitable protected areas set out bottomless metal 4-liter cans so that they project above the ground about 6 inches and have about the same distance below the surface. Place the cans in such a way that each surrounds a plant of the type being tested. Place, say, 6 such cans at each location. In each can place a weighed amount of feces from a bovine or ovine with either a pure or mixed high intensity infection of gastrointestinal helminths. Record temperature and rainfall at each site.

At intervals at each location, collect the contents of a can, including the contained plant material and determine by proper extraction methods the numbers of surviving larvae. (2) To check effects of pasture treatments such as burning or clipping on the survival of worm larvae, select two adjacent pastures that have had recent use by animals harboring worm parasites. Treat one pasture according to the method being tested; the other will serve as control. Expose separate groups of worm-free calves in a comparable manner on each pasture. To determine survival time of larvae on different types of grasses used for seeded pastures, select two adjacent pastures, one with the grass being tested and one with native grasses as a control. See that both pastures are contaminated to about the same extent with manure from infected animals. Expose worm-free calves (sheep may be used as test animals) on the test and control pastures in a comparable manner.

Because older animals usually lose their susceptibility to worm parasites, it is important to use young animals (less than one year old). Stocking rates for testing should approximate natural conditions. Fecal examinations (Mcmaster and Baermann methods) should be made weekly beginning at 4 weeks and continued for at least 6 to 8 weeks. At the termination of the test, all of the animals, or at least representatives, of both principal and control groups should be subjected to necropsy in order to confirm the identity of the parasites involved. If this is not feasible, examinations based on fecal samples may be made more informative by using more exacting procedures. The methods described here will provide information about lungworms as well as helminths of the gastrointestinal tract. This type of experiment ideally should be carried out with animals raised worm-free, but due to the expense involved this is sometimes not possible. In place of worm-free animals one might use animals that have been treated with multiple doses of appropriate anthelmintics and subsequently held in clean dry lots or in portable pens until used. Only young (no more than 4 to 6 months old) animals should be used.

5. Duration: Two years

6. Cost in guaranies (126 GS = $1.00):

	Year		
	1	2	Total
Calves	Use owner animals		No charge
Plastic bags	1,000	1,000	2,000
Mcmaster slides	3,000		3,000
Mechanical counter	6,000		6,000
Ice boxes	1,200		1,200
Ice	1,000	1,000	2,000
Personnel:			
Professional			No charge
Student	60,000	60,000	120,000
Travel	Combine with Ura project		
	72,200	62,000	134,200

RESEARCH PROPOSAL

Parasites and Parasitic Diseases of Cattle in Paraguay

1. Title: Worm Parasitism in Dairy Calves in the Asuncion Area

2. Objectives: To evaluate the importance of worm parasitism in dairy calves, to identify the problems, and to evaluate control measures of a sanitation or medicinal nature to solve the parasite problems.

3. Background: Young dairy calves heavily concentrated on pastures could be expected to harbor at times pathogenic infections of worms. No information is available at this time concerning the importance of worm parasites in dairy calves.

4. Methods: Collect fecal samples from pastured, untreated calves on 6 dairies twice a month during the 3-month grazing season. Approximately 10 percent of each herd should be sampled on each sampling date. Examine the samples for worm eggs, identifying them in so far as possible and listing the numbers per gram of feces. In each case Baermannize a weighed portion of each sample and record the number of lungworm larvae recovered. Record pertinent data for each sample such as location, date, breed, age, and any other information of value. Calves sampled should not have been treated, and they should be about 3 months to one year of age. After identifying the problems, evaluate control methods by sanitation and/or drugs in controlled experiments. This might be set up as a program for three summers, utilizing the first summer to evaluate the problems and the second and third for evaluating control methods. There would be control groups the second and third summers and these would provide additional data from untreated animals.

5. Duration: Three summers

6. Cost in guaranies (125 Gs = $1.00):

	Year			
	1	2	3	Total
Plastic bags	1,000	1,000	1,000	3,000
Funnels	600			600
Tubing and clips	600			600
Flotation medium	500	500	500	1,500
Personnel:				
Professional				No charge
Student	No charge	45,000	45,000	90,000
Travel				No charge
	2,700	46,500	46,500	95,700

OBJECTIVE 3

Outline for a Short Course in Parasitism and Animal Sanitation

There are many diverse forms of parasites in and on animal hosts. There are parasites which live on the skin called external parasites. These include the fleas, lice, ticks, mites, and flies. Many more parasites occur inside the host animal. These include the protozoa, which are organisms of one cell, and the worms. Examples of the protozoa are the coccidia, trichomonads, trypanosomes, amoebae, and plasmodia. The most important protozoan diseases of livestock are coccidiosis and trichomoniasis.

The worms make up the largest group of internal parasites. There are flatworms and roundworms. There are about 40 species of roundworms alone which occur in ruminants. The flatworms consist of tapeworms and flukes. All of the flatworms occurring in livestock require intermediate hosts in which the larval stages develop and grow. A tapeworm called Moniezia, found in cattle and sheep, is transmitted by grass mites; the adults live in the small intestines of the definitive hosts. A tapeworm of man, called Taenia saginata, has larval stages which develop in the muscles of cattle. Another tapeworm of man has larval stages which grow in the muscles of the pig. These adult tapeworms live in the small intestine of man. The adults of both of these tapeworms produce eggs which pass out of the hosts in feces. Cattle and pigs become infected when they eat forage which has been contaminated with these eggs.

Flukes produce eggs which pass out in the feces. When these eggs reach an aquatic environment, they hatch, giving rise to larval forms which penetrate snails. There is development within the snails through additional stages, and finally there emerges from the snail a stage which encysts on forage and is infective to ruminants. The tapeworms and liver flukes may be controlled through the administration of drugs to remove the adult stages from their definitive hosts. Infection of pigs and cattle with the pork and beef tapeworms may be prevented by sanitary disposal of excrement from infected humans. To prevent infection of humans, beef and pork should be thoroughly cooked before being eaten. Fluke control may be expedited by the use of chemical or biological agents which destroy snails.

For the most part, roundworms do not require intermediate hosts; they have direct life cycles. The eggs from the manure develop in the soil or on vegetation and give rise to larval worms which are ingested accidentally as the cattle and sheep graze. Prevention entails keeping contamination of forage to a minimum. Drugs can be used to remove worm burdens from cattle and sheep.

Information about the more important parasitic conditions occurring in cattle in Paraguay is tabulated in the accompanying table and outlines for demonstrations. A summary of information concerning parasite control through sanitation is appended.

THE PRINCIPAL PARASITES AND PARASITIC DISEASES OF CATTLE IN PARAGUAY

Name	Main effects	Means of transmission	Diagnosis	Treatment of choice
Ura	Skin and subcutaneous lesions	Carrier arthropod	Inspection of skin	Systemic organophosphates
Ticks	Dermatitis and anemia	Direct contact, contaminated areas	"	" "
Lice	Dermatitis and anemia	"	"	" "
Mites	Dermatitis	"	"	" "
Lungworms	Pneumonia	Contaminated forage	Larvae in feces	Tetramisole (levo)
Nodular worms	Diarrhea, nodules in intestinal walls	" "	Eggs in feces	" (1)
Stomach worms	Anemia	" "	" " "	" (1)
Hookworms	Anemia	Contaminated forage and bed grounds	" " "	" (1)

(1) Also thiabendazole, phenothiazine, methyridine, and other compounds including some organophosphates

DEMONSTRATIONS

URA

Display:

Adult fly	Carrier arthropods with attached eggs	Larvae from skin
Diagram of larvae in soil	Diagram of life cycle	Lesions on surface and beneath skin
Samples of drugs for treatment	Neguvon Asuntol BHC Others available	

- - - - - - - -

TICKS

Display:

Adult tick	Seed ticks	Attached ticks
Lesions caused by ticks	Diagram of life cycle	Samples of drugs (see Ura)

- - - - - - - -

LICE AND MITES

Display:

Adults	Adults in situ	Samples of drugs (see Ura)

- - - - - - - -

LUNGWORMS

Display:

Adults	Adults in situ	Larvae
Diagram of life cycle (note lack of eggs)		Sample of drugs: Tetramisole (levo) oral or injectable

NODULAR WORMS

Display:

Adults	Adults in situ	Larvae
Eggs	Diagram of life cycle	Samples of drugs: Tetramisole Phenothiazine Thiabendazole Methyridine Others

- - - - - - - -

STOMACH WORMS

Display:

Adults	Adults in situ	Larvae
Eggs	Diagram of life cycle (see nodular worm)	Samples of drugs (see nodular worm)

- - - - - - - - -

HOOKWORMS

Display:

Adults	Adults in situ	Larvae
Eggs	Diagram of life cycle (Note skin penetration)	Sample of drugs (see nodular worm)

- - - - - - - - -

Parasite Control and Sanitation

Since all parasites move from one host animal to another as a means of propagating their kind, overcrowding of livestock promotes parasitism. For controlling Ura it may be helpful to fence cattle away from wooded areas frequented by the Ura flies and the carrier insects. Almost any animal except the horse may be a source of infection for cattle; it may be helpful, therefore, to eradicate, or reduce the populations of these reservoirs of infestation. Where feasible, eliminate or spray wooded areas and ponds to reduce numbers of fly and mosquito populations.

Tick populations may be reduced by dragging sacks or other cloth materials over badly infested vegetation.

Control gastrointestinal worms and lungworms by:

(1) Preventing overstocking and overgrazing

(2) Resting pastures

(3) Breaking up and scattering fecal pads during grazing season

(4) Burning off pastures

(5) Clipping pastures

(6) Plowing pastures

(7) Utilizing types of forage which afford a minimum of protection to the free-living larval stages.

NOTES ON THE TREATMENT AND CONTROL OF PARASITES AND PARASITIC DISEASE

One of the striking things about the treatment of diseases of livestock in Paraguay is that the drug manufacturing companies are very active and have vigorous advertising programs. The dispensing of veterinary products is a well organized operation consisting of small stores handling no other products. These stores are usually operated by veterinarians and are to be found even in small communities. The telephone directory of the City of Asuncion lists 16 such stores in its classified section, and there may be additional ones which have no telephone listing. This means that such veterinary products as anthelmintics and pesticides are readily available to the livestock producers. Costs of these products generally are low by U. S. standards. To treat one bovine with Neguvon, a compound widely used for both internal and external parasites, the cost is only 25 cents. Moreover, there are no restrictions on the use of injectable compounds, and this type of administration usually requires smaller dosages of the chemicals than oral administration. Asuntol, BHC, DDT, and Malathion were some of the pesticides noted as

being readily available. Anthelmintics on hand included tetramisole, injectable and for oral use. This compound is important in Paraguay because of its demonstrated efficacy against both lungworms and roundworms of the gastrointestinal tract. Also available are piperazine compounds, phenothiazine, thiabendazole, methyridine, and several other anthelmintics.

The comments which follow deal with the control of Ura on the one hand and worm parasites on the other. Obviously, the recommendations are made with only incomplete knowledge concerning problems the research proposals are designed to elucidate.

Recommendations for Control of Ura

The larvae in the skin of cattle are affected by several commonly used insecticides applied by dipping the animals, by spraying, and by pour-on methods. Some of the more versatile organophosphates can be applied in these ways but also have the added advantage of affecting ectoparasites when given by mouth or by injection. These methods of treatment, however, can be used only intermittently. Animals can become reinfested with Ura within a matter of hours after conventional individual treatment with drugs. Therefore, a low-level continuous treatment as a means of prevention would be highly desirable and would obviate the expensive and time-consuming process of rounding up and running cattle through the chutes for individual treatment. Continuous low-level administration or application of drugs might be accomplished by means of backrubbers or suspended gunny sacks saturated with oil, salt blocks, loose salt, salt-mineral mixes, and/or feed concentrates. The drugs of choice are the organophosphates, particularly Neguvon, Asuntol, Ruelene, and other compounds which have a demonstrated effect against cattle grubs in general, as well as against ticks, lice, and mites. Some of these compounds, when applied externally, may have an effect against round worms of the gastrointestinal tract.

To be successful there must be a more or less regular intake and/or application of sufficient quantities of the drug. Backrubbers may not be effective generally in Paraguay because of the abundance of patches of forest in most pastures. In situations of this kind, according to some observers, cattle will do their scratching on trees and other growth rather than man-made structures. Also salt may not be a suitable vehicle for the administration of drugs in localities where there is a high salt content in the soil. As has been advocated by various persons, it is perhaps wise to use a method of inducing the cattle to expose themselves to backrubbers and other self-treatment devices by placing these devices where cattle are forced to come in contact with them in gaining access to salt boxes, feed boxes, or watering sources. If the salt is medicated, there is the added advantage of simultaneous intake and external application. Work done in Peru has demonstrated that periodic administration of loose salt containing 10% Neguvon (at three week intervals) may reduce Ura infestations markedly over a period of time. This procedure may not bring the immediate results that might be expected from continuous intake of the medicinal agent, but its efficacy should be evaluated under Paraguayan conditions on the assumption that less time would be consumed putting out salt once every three weeks than would be consumed in keeping the cattle supplied with salt at all times. Theoretically, continuous intake of sufficient amounts of the drug in use would

eradicate Ura promptly by complete prevention of reinfestation, while intermittent intake at three week intervals would permit some reinfestation but would gradually reduce the numbers of larvae emerging from the cattle and completing the life cycle. To be sure, the organophosphates, whether applied externally or internally or both, because of their high toxicity, should be used strictly according to container labels. After the use of these compounds, as well as others, a waiting period may be required before treated animals may be slaughtered for human consumption. Other insecticides which have been shown to have an effect against Ura are available in the country; these include Gammexane, DDT, and Toxaphene. In the event of drug resistance, these compounds may be considered.

Control by sanitation: This may be an important method after more information about the biology of the parasite in the country becomes available, particularly information about the habits of the Ura fly and the carriers it utilizes. It appears at this time that forested areas may be the preferred sites for the Ura fly and the carriers. If so, it may be feasible to keep cattle away from such areas during the times of greatest fly activity. Also, aerial spraying of wooded areas might result in eradication, or at least reduction in numbers, of the responsible flies.

In this connection, Dr. Benitez and I had an interesting experience while on a field trip December 15 at the Ranch Elsa, about 15 Km north of the city of Villarrica. Dr. J. Bartrina of FAV had suggested we visit this ranch because of the high incidence of Ura. Upon arrival at the Ranch Elsa, we soon confirmed what Dr. Bartrina had told us. We requested that ranch employees stake out in a nearby wooded area two infested bovines in an effort to attract Ura flies and/or carrier insects. During a one and one-half hour period, we collected with nets about 50 flies but no mosquitoes. Fortunately, two of the flies turned out to be carriers of Ura, as was evidenced by the typical packets of eggs attached to the abdominal areas. The carriers of Ura have not previously been determined for Paraguay, so Drs. Benitez and Masi are being encouraged to put the findings on record. Excellent photographs of one of the flies with Ura eggs attached were made by Dr. Ben Norman, NMSU-AID.

Recommendations for Control of Worm Parasites

Liver flukes do not constitute a problem in Paraguay. However, there is a wide variety of roundworms of the gastrointestinal tract, and lungworms and tapeworms are present in cattle in many areas. No one drug will remove all of these kinds of parasites. Thiabendazole affects most roundworms of the gastrointestinal tract, and it may be given orally as a powder, as a drench, or in the form of boluses; it may also be given in feed. Neguvon may be given orally or as an injectable, and being a systemic, it affects ectoparasites when given internally. Neither of these compounds affects lungworms or tapeworms. Tetramisole may be given orally or as an injectable. It has the advantage of affecting both lungworms and roundworms of the gastrointestinal tract; it has no action against tapeworms. Tapeworms may be readily removed by oral administration of Mansonil (Yomesan), which compound has no appreciable action against roundworms.

Other drugs for the treatment of worm infections are readily available in Paraguay; however, the overuse of drugs should be avoided. Evaluate carefully the need for drug treatment and avoid the expense of unnecessary use of drugs and the handling of animals. Worm parasites may develop a resistance to certain chemical compounds, and the greater the use of the compounds, the sooner the resistance will develop. Often the treatment of older cattle with light infections cannot be justified.

Control by sanitation: Worm and protozoan parasites are spread from one animal to another usually through soil and/or grass contaminated with manure. This means that overstocking and overgrazing promote parasitism because of the high density of manure on overused pastures. Resting (rotating) pastures tends to reduce the chance of infection because the free-living stages of the worm parasites are susceptible to adverse climatic conditions such as freezing, drying, and high temperatures, so the longer a pasture is rested the lower the numbers of surviving larvae. The burning off of pastures would obviously destroy larvae as would the plowing of pastures. Dense, tall types of forage encourage the survival of larvae while short, more open types discourage survival. This means that some types of permanent pastures might be preferred over others in reducing parasitism.

ACKNOWLEDGEMENTS

I would like to acknowledge the very fine cooperation extended to me during my stay in Paraguay. Professor Charles Gay, Dr. Ben Norman, Dr. George Ellis, and other individuals connected with NMSU-AID were most helpful. Dr. V. I. Plath, USDA-PASA, was generous with assistance.

I appreciate very much the prompt reply from Dr. Roger Drummond, Entomology Research Division, ARS, USDA, Kerrville, Texas, to my request for information about the Ura problem. Dr. Drummond supplied a bibliography on the subject, a supply of reprints, and observations on the efficacy of backrubbers as a means of applying insecticides to cattle. While I was in Paraguay, my regular employer, the Veterinary Sciences Research Division, ARS USDA, sponsored a trip to Corrientes, Argentina, for consultation with Prof. Dr. O. J. Lombardero of the Facultad de Agronomia y Veterinaria, Universidad Nacional del Nordeste. Dr. Lombardero and I had corresponded over a period of two to three years about our common problems in parasitology, and it was a pleasure to meet him personally for further discussion of these problems. I soon learned that Dr. Lombardero and coworkers had engaged in considerable research on Ura in the Formosa, Argentina, area and had identified a carrier fly. Also, he had conducted some interesting propagation experiments with the parasite in the laboratory. These things had a direct bearing on the Paraguay project because of the similarity of climatic and other ecological conditions, and to the close proximity of Paraguay and Argentina. Dr. Lombardero's work on Ura had been published but had not been available to the Asuncion workers. He provided reprints of his publications and these were turned over to FAV.

Other drugs for the treatment of worm infections are readily available in Paraguay; however, the overuse of drugs should be avoided. Evaluate carefully the need for drug treatment and avoid the expense of unnecessary use of drugs and the handling of animals. Worm parasites may develop a resistance to certain chemical compounds, and the greater the use of the compounds, the sooner the resistance will develop. Often the treatment of older cattle with light infections cannot be justified.

Control by sanitation: Worm and protozoan parasites are spread from one animal to another usually through soil and/or grass contaminated with manure. This means that overstocking and overgrazing promote parasitism because of the high density of manure on overused pastures. Resting (rotating) pastures tends to reduce the chance of infection because the free-living stages of the worm parasites are susceptible to adverse climatic conditions such as freezing, drying, and high temperatures, so the longer a pasture is rested the lower the numbers of surviving larvae. The burning off of pastures would obviously destroy larvae as would the plowing of pastures. Dense, tall types of forage encourage the survival of larvae while short, more open types discourage survival. This means that some types of permanent pastures might be preferred over others in reducing parasitism.

ACKNOWLEDGEMENTS

I would like to acknowledge the very fine cooperation extended to me during my stay in Paraguay. Professor Charles Gay, Dr. Ben Norman, Dr. George Ellis, and other individuals connected with MSU-AID were most helpful. Dr. V. I. Plath, USDA-FASA, was generous with assistance.

I appreciate very much the prompt reply from Dr. Roger Drummond, Entomology Research Division, ARS, USDA, Kerrville, Texas, to my request for information about the Ura problem. Dr. Drummond supplied a bibliography on the subject, a supply of reprints, and observations on the efficacy of derris rubbers as a means of applying insecticides to cattle. While I was in Paraguay, my regular employer, the Veterinary Sciences Research Division, ARS, USDA, sponsored a trip to Corrientes, Argentina, for consultation with Prof. Dr. O. J. Lombardero of the Facultad de Agronomia y Veterinaria, Universidad Nacional del Nordeste. Dr. Lombardero and I had corresponded over a period of two to three years about our common problem in parasitology, and it was a pleasure to meet him personally for further discussion of these problems. I soon learned that Dr. Lombardero and coworkers had engaged in considerable research on Ura in the Pocosas, Argentina, area and had identified a carrier fly. Also, he had conducted some interesting propagation experiments with the parasite in the laboratory. These things had a direct bearing on the Paraguay project because of the similarity of climatic and other ecological conditions, and to the close proximity of Paraguay and Argentina. Dr. Lombardero's work on Ura had been published but had not been available to the Asuncion workers. He provided reprints of his publications and these were turned over to PAV.

THE SMEAD MFG. CO.
HASTINGS, MINN. U.S.A.
No. 1118 G